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ABSTRACT

This report details the evaluation of 25 teachers who during 1970-71 participated in an environmental inservice workshop. They, plus a control group of 22 teachers, were tested before and after the workshop with two environmental awareness surveys. These surveys did not indicate a greater final knowledge of environment in the experimental teaching group. Changes in values occurred, however, with significant shifts in the experimental teaching group towards idealism and humanism and away from both a scientific and economic orientation towards life. Part II, the major portion of this report, contains seven individual project reports done by psychology undergraduate and graduate students for participating teachers who wished research assistance. Through observation and awareness analysis they evaluated the effectiveness of the environmental learning packages which the teachers had developed and then used in their elementary and junior high classes. The overall teacher training and curriculum development plan of the Northwest Environmental Education Center (NEEC) is outlined in SO 002 082. (Author/AWW)

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Evaluation of Environmental Education in the Sedro-Woolley School District

Patricia W. Lunneborg and Clifford E. Lunneborg

Part I of this report details the evaluation of 25 Sedro-Woolley teachers who during 1970-71 participated in an environmental workshop sponsored by Northwest ~~Environmental~~ Education Center (NEEC). They and a control group of 22 teachers from nearby Marysville were administered before and after the workshop an Environmental Awareness Survey, Allport-Vernon-Lindzey Study of Values, and Test of Basic Assumptions. Although the untried Survey did not indicate greater knowledge of environment in the experimental group, this group was highly aware--significantly more than the control and at the 70th percentile compared with a group of aware college students. Remarkable changes in values occurred, however, with significant shifts in the experimental group towards idealism and humanism and away from both a theoretical (scientific) and economic orientation towards life. No such changes occurred in the control group. The workshop must be considered a success in dramatically changing values.

Part II of this report contains seven individual project reports done at the request of NEEC in April and May 1971 by psychology undergraduate and graduate students for teachers who wished research assistance in evaluating their innovative learning packages which they were trying out in their classes.

Bureau of Testing Project: 1070-166

Evaluation of Environmental Education in the Sedro-Woolley School District[1]

Part I

Patricia W. Lunneborg and Clifford E. Lunneborg

One of the goals of the Northwest Environmental Education Center (NEEC) is the creation of a school district model for promoting, as President Nixon puts it, "environmental literacy" in American society (Ryan, in press). To that end during the 1970-71 school year twenty-five teachers from the rural Sedro-Woolley School District participated in a weekly environmental workshop. Not only were they to be trained, but they were to begin to transmit their new ecological world view to their students through various teaching innovations. The "learning packages" they developed were to represent the first stage of a comprehensive K-12 environmentally sensitive curriculum.

As Ryan indicated, NEEC's thinking about environmental education goes much beyond the definition given in Public Law 91-516 (October 30, 1970) wherein it is to deal with man's relationship to his natural and manmade surroundings, particularly the topics of "population, pollution, resource allocation and depletion, conservation, transportation, technology and urban and rural planning." NEEC is more concerned with clarifying a philosophical position, with identifying pathogenic national premises, and

[1]William Stocklin is Director of the Northwest Environmental Education Center, Huxley College, Western Washington State College, Bellingham, Washington. John Miles is the director of and instructor for this educational model project. Sedro-Woolley's population in 1968 was 3,825.

with operationalizing new values which enhance the quality of human life. Their emphasis then is not so much on knowledge per se but on values, decisions, and moral responsibilities.

The object of this study was to identify the impact of this year of training upon the teachers. This was a heady task given the philosophical orientation of the Center and the imperative to use instruments which were objective, reliable, valid, and behavioral (Stapp, 1970).

Method

Subjects. The experimental group consisting of the 25 teachers in Sedro-Woolley schools ranged in age from 21 to 65 with median age of 30. They included 17 men and 8 women. Their classes ranged from first grade to the senior year in high school. These teachers had volunteered to participate in the workshop for which they were reimbursed and their projects supported by a grant to the Center. The control group of 22 teachers were from the nearby town of Marysville and had 12 men and 10 women ranging in age from 23 to 65 (median 27). They too taught grades 1 through 12. Details of the treatment condition, i.e., the content and conduct of the workshop, may be obtained from the project director.[1]

Instruments. In October 1970 and June 1971 the workshop instructor administered to the two groups of Ss three tests: Study of Values (Allport, Vernon, and Lindzey, 1960), the Test of Basic Assumptions (Levit and Morrison, 1958), and an experimental Environmental Awareness Survey (1970) which consisted of 65 multiple-choice items dealing with factual, attitudinal, and value-oriented material related to the environment. The latter was specifically constructed for this evaluative project and was

accompanied by a biographic data sheet to elicit behavioral data such as how many cars S owned, how S spent his vacation, and if had S an electric knife or not. The Study of Values measures the relative standing of six motives within an individual: theoretical (scientific), economic, aesthetic, social, political, and religious. The Test of Basic Assumptions compares within an individual three philosophical orientations, realistic, idealistic, and pragmatic, in four contexts--planning, human abilities, business, and life philosophy.

Analysis. The workshop instructor's responses to the Environmental Awareness Survey in October and June were compared to develop an empirical scoring key. He was not told of the purpose to which his scores would be put. The 50 items he answered the same on the two occasions constituted both the ultimate Survey and "right or wrong" answers. The variety of philosophies to which the teachers were exposed by this very eclectic and well-read individual precluded constructing a scale consistent with one given moral position, although in the future such theoretically-based tests of values and decisions will be attempted. Instead, what was "correct" was agreement with this expert's consistent opinion which he had been communicating over several months.

For each of the three tests comparisons were made by selected t-tests between the two groups of subjects at the outset and of the changes occurring in each over the year. All comparisons were made only for Ss who completed both administrations of a particular test. One shortcoming of this study was the considerable attrition on the second occasion particularly in the control group. Naturally the greater the sample size the more reliable the results.

Results

The most remarkable results have to do with changes in values and outlook. In October both experimental and control groups had nearly identical value profiles which did not differ significantly in regard to any dimension. On the Scale of Values (Figure 1) they were both high on theoretical and low on the economic and religious scales (the difference on the economic scale is not significant). On the Test of Basic Assumptions both groups were pragmatic with respect to planning, human abilities, and life philosophy; towards business the realistic and pragmatic outlooks were weighted equally. However, the experimental and control groups differed importantly when the change over the year was evaluated. On neither test did the control group change significantly over time. The experimental group, in contrast, revealed sharp shifts on the Study of Values (Figure 2). Their low economic scores dropped even further; their theoretical-scientific orientation dropped significantly. What increased dramatically were their social values. In persons high on the social scale, "The highest value for this type is love of people...it is the altruistic or philanthropic aspect of love that is measured. The social man prizes other persons as ends, and is therefore himself kind, sympathetic, and unselfish. He is likely to find the theoretical, economic, and aesthetic attitudes cold and inhuman (Allport, Vernon, and Lindzey, 1960)."

On the Test of Basic Assumptions the experimental group became markedly more idealistic in all four contexts. With regard to planning, this represented a shift towards rational, long-range thinking, and greater sensitivity towards others. With regard to human abilities, the shift was in the

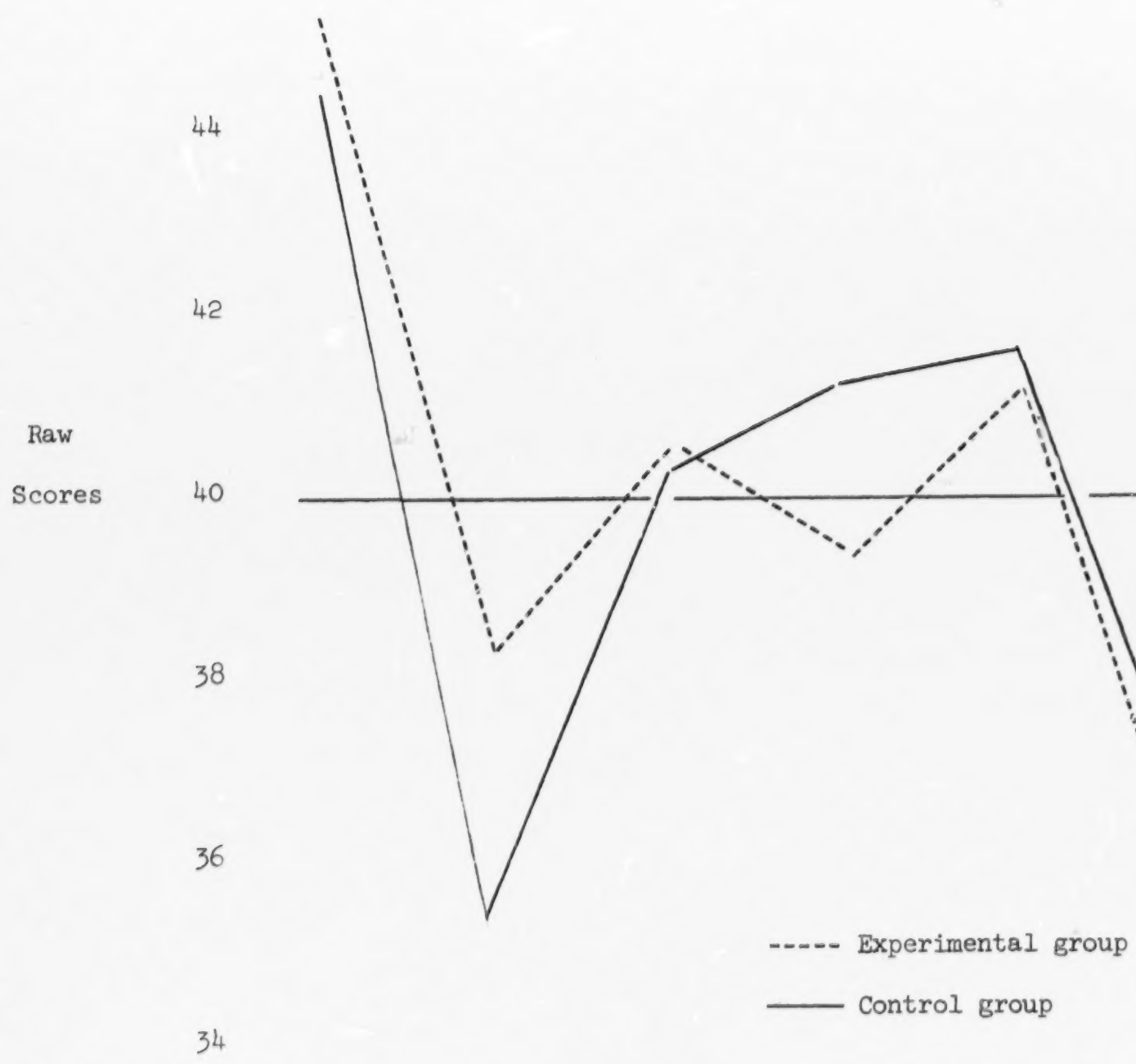

Figure 1

Allport-Vernon-Lindzey Scale of Values

Pre-Test Scores

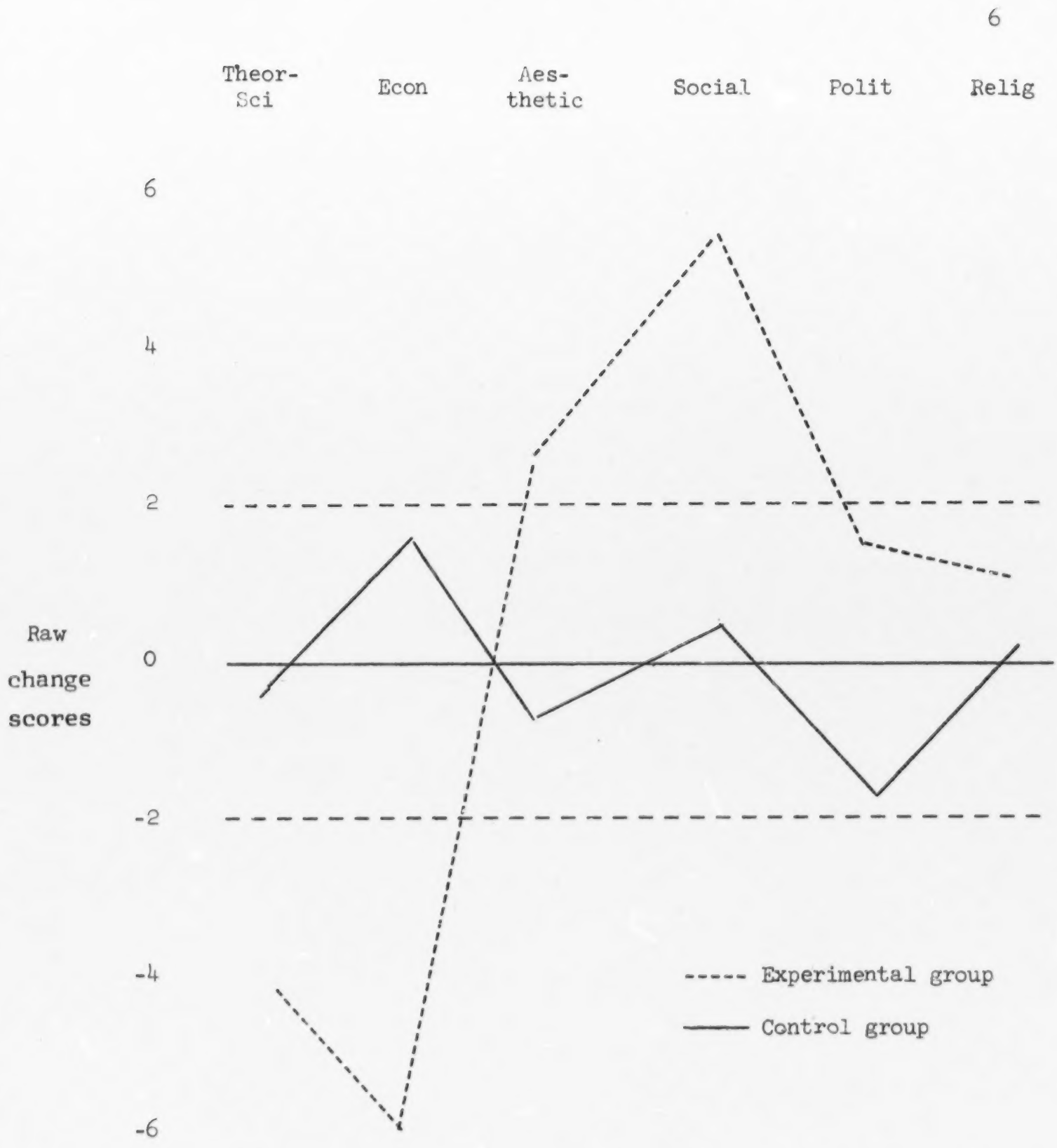

Figure 2

Allport-Vernon-Lindzey Scale of Values

Change Scores '

direction of evaluating people more in terms of inner motives and developed abilities than in terms of others being strictly determined by heredity or culture. In the area of business and economics the experimental group reduced most issues to the personalities, attitudes, and interests of the people involved. The idealistic philosophy of life (within this test) involves the notion that reason will lead to correct moral positions and that the highest value is respect for fellow man. Overall, the idealist believes in the perfectability of man.

The Environmental Awareness Survey revealed that the two groups were significantly different in October but that with time the control group actually improved a bit more than the experimental group. The experimental group was perhaps so high in initial awareness, that there was relatively little room for them to grow in terms of more facts and better attitudes about environment. To give some idea of their degree of sensitivity before the workshop, compared with University of Washington students (N = 175) in environmental classes spring 1971, these teachers were at the 70th percentile. In regard to the behavioral correlates of awareness, there was a nonsignificant tendency for the experimental group to consume less while the control group (like most Americans) tended to increase their possessions.

Discussion

To what should these changes in values be attributed? What brought about this greater love of man and respect for his capacity to reason his way through problems? Clearly, this new value orientation stems largely from the working paper cited by Ryan (in press) as of great significance to NEEC, "Alternative futures and educational policy" (Harman, 1970). Indeed,

this paper states, "In particular, emotional and intellectual awarenesses are needed of the ineluctable fact that we are one race, on one planet, with total responsibility for the future of both (p. 19)." Sedro-Woolley teachers have definitely become more humanistic, more person-centered, and to have thoroughly abandoned the notion that men are essentially separate from each other and have no responsibility for the effects of their actions upon others. Clearly, values changed because that was the conscious or unconscious arena in which instructor and "pupils" wanted change to occur.

But it would appear that the behavioral evidence of these changed values must come from classroom activities (see Part II) and not from personal life style, i.e., not from checklists to see how many got rid of the second car, the second TV, the oil stock. Perhaps getting rid of some things makes less sense than keeping them, e.g., wearing a coat of wild animal skins until it wears out, not remodeling to tear out the fireplace or the electric garbage disposal. Perhaps concomitant behaviors just take a long time to appear. But probably the most parsimonious explanation is the inadequacy of this tried-for-the-first-time environmental survey and biographic data sheet. On the basis of these two teacher administrations and the student sample, the bad items within the two can now be culled, new items written, and a better model available for the future. From an evaluator's point of view mistakes are valuable (not as valuable as positive results), because it should be possible to see that they won't happen again.

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Evaluation of Environmental Education in the Sedro-Woolley School District

Part II

Jay Adams, Paul Davenport, David Gruhn, Peggy Hollenbeck, Sandra Mitchell, and Brett Trowbridge

Following are seven individual project reports conducted by University of Washington undergraduate and graduate research assistants in psychology. The students attended an evening workshop end of March 1971 at which they heard the 25 teachers describe their environmental teaching efforts. The students then chose the teachers they felt they could help the most and traveled in the next two months to the Sedro-Woolley schools to make their observations, test, rate, etc.

The major flaw in their assessment projects was that no pre-testing had occurred. This diminished the probability of finding significant results and in the future evaluation should be an ongoing teacher activity in such an important educational innovation.

Individual Project Report No. 1

Environmental Project for Mr. Herb Sargo, 8th Grade Science, Lucille Lumbarger School, Burlington

Jay Adams

Problem

This study was designed to determine the effects of an environmentally-oriented approach to the teaching of eighth grade science and to evaluate how effectively this teaching program accomplished the goals of the teacher who devised it.

The program, designed by Herb Sargo at the Lucille Lumbarger School in Burlington, was intended to be process-oriented and relevant to the local community, and to operate on the principle of "each one teach one." Thus the format was somewhat similar to that of a college seminar. The students in the class were divided into groups of three and given a choice of topics which included solid waste disposal and recycling, population, air pollution, water pollution, natural resources, pesticides, community planning and development, wildlife management, Skagit Valley geography, and lumbering and related industries. Each group was given the task of becoming an "expert" on a particular topic and then informing the rest of the class. The teacher, operating on the belief that he should do nothing for the students that they could do for themselves, served as a resource person and made available an extensive bibliography of relevant readings, as well as a list of organizations which provide environmental information. It was up to the students in a group to coordinate their efforts, to gather their

own reading materials, and to make the necessary arrangements for any outside speakers they wished to invite to talk to the class.

Method

Mr. Sargo had a number of goals in mind which he hoped this program would accomplish. He administered his own tests to determine how much factual knowledge about resources and environmental problems had been gained by the students. In addition, it was hoped that the students would acquire a generally more questioning attitude, a greater awareness of relationships, and an increased sense of cooperation. A shift in values toward less materialism and a more frugal, less extravagant life style was another goal. Finally, the program aimed at increasing initiative and self-motivation for learning, and enabling students to do things for themselves.

In order to assess the effectiveness of the program in accomplishing these goals, Mr. Sargo's two eighth grade classes (experimental group) were compared with a control group, another eighth grade science class in Burlington on a number of measures: a junior high school adaptation of the Bureau of Testing's Environmental Awareness Survey, the Similarities subtest of the Wechsler Adult Intelligence Scale (WAIS) as an index of reasoning and understanding relationships, and Rotter's Internal-External (I-E) Scale to determine degree of independence and initiative. No reliable measure of cooperation could be found, so none was included.

In addition, measures of preference for various academic subjects were taken in order to see whether the environmental awareness program had resulted in a generalized interest in all science courses and in an enthusiasm for taking more science in the future. Students were given sixteen pairs

of academic subjects consisting of one science and one non-science subject (e.g., English and Biology) and were asked to circle which they preferred in each pair. They were also asked to indicate whether, having taken eighth grade science, their interest in science was greater, less, or about the same. Finally, each student was asked to write a five minute essay on both of the following topics: "What do you think the study of ecology is?" and "What do you think would happen if money didn't exist anymore?"

Results and Discussion

Environmental Awareness Survey. There were four items on the Environmental Awareness Survey that discriminated the experimental group from the control group at a statistically significant level ($p < .05$; chi squares). These were:

"A small electric car pollutes less air and makes less noise than the cars we use now, but a small electric car is not practical for driving in the city." A majority of the control class accepted this statement as true, while most of the experimental students endorsed "False," presumably because they rejected the second part of the statement that an electric car would not be practical for city driving.

"You are a farmer who believes in ecology. What do you do?

a. Trade in your tractor for horses because animals do not pollute the air, do not use gas, and make cheap fertilizer.

b. Keep your tractor because there isn't enough food in the world, and the tractor helps you grow more food."

Significantly more students in the experimental group endorsed "a" on this item while those in the control group endorsed "b." The students who were

exposed to environmental education seem to have adopted a more "romantic" attitude towards the problem, a la Thoreau, while control students remained oriented toward the more obviously pragmatic response.

"Science teachers should show their students why it is wrong for a family to have more than two children." Students from the experimental classes endorsed the idea that teachers should indeed do this, while the control students disagreed. There was a sufficient impression made on the experimental students as to the seriousness of the population problem to override the traditional American individualistic value that "How many children people have is no one else's business but their own."

"Compare the environmental problem with the war in Viet Nam, crime, poverty, and student revolts. Is ecology
a. most important?
b. more important than some and less important than others?
c. less important than most of the other problems?"

Student responses to this item were as follows: experimental, (a) 1, (b) 11, (c) 3; control, (a) 5, (b) 3, (c) 0. That most experimental students endorsed the wishy-washy middle alternative and three thought ecology was less important suggests that there are some shortcomings in the program in its present form.

In addition, the following items approached statistical significance:

"Putting chemicals into the water is bad because some chemicals
a. kill people.
b. kill fish and other animals in the water.
c. make algae grow which chokes out other animals.
d. give water a bad smell."

Most of the experimental students endorsed "b" while more of the control students endorsed "c."

"If the United States population keeps on growing at the present rate, the population will double in

a. 10 years.
b. 35 years.
c. 75 years
d. 103 years."

More experimental students tended to answer "b," while most of the controls answered "a." No one answered "d" and only one "c."

"People want to buy things because
a. people are born wanting to buy things and have more.
b. people learn to buy things and want more
c. of advertising, which makes people want more."

Most experimental students endorsed "c" while most control students endorsed "b." The experimental students tended to be more sensitive to the part the advertising industry plays in problems affecting the environment.

Similarities (WAIS). The most interesting and significant findings are those on Similarities. This subtest is designed to assess ability in verbal concept formation, an important component in what is referred to as "I.Q."

Students in the experimental group were administered this test, which was standardized on a population sample ranging from sixteen through 75 years of age. These students scored an average of 15.8 raw score points. Due to an oversight on the part of the control class teacher, his students were not given Similarities. However, an examination of the tables of scores for the population sample on which the WAIS was standardized reveals that the highest mean score on this test is attained by individuals in the age groups between 20 and 24, and 25 and 34; the mean score for these groups is between fourteen and fifteen raw score points. Before 20 and after 34, the mean score is lower. Thus, at the age of thirteen, these experimental students were already scoring above the mean of the peak age groups on

Similarities, indicating Mr. Sargo was somewhat successful in achieving his goal of making students more aware of relationships. This finding also suggests that there may be a relationship between some aspects of general intelligence and the teaching of environmental education.

Rotter Internal-External Scale. It was hypothesized that one of two effects might occur as a result of exposure to environmental education. First, students might become more aware of the role and importance of individual responsibility in ecological problems resulting in a higher internal score on the I-E Scale which reflects feelings of control over the environment. On the other hand, students might become overwhelmed by the enormity of the environmental problem, the inability of a single individual to take any effective action against huge industries, etc., leading to a feeling of powerlessness, and an elevated external score on the I-E Scale.

In fact, neither of these effects appears to have occurred. The mean scores on the I-E Scale showed virtually no difference between the two experimental classes ($\bar{x}$ = 9.8) and the control class ($\bar{x}$ = 9.6).

Subject Preference and Interest in Science Ratings. There were no significant differences in preference for science courses between the two groups. The ratings of interest in science as a result of having taken the eighth grade science course were as follows:

	Experimental	Control
More interested	13	9
About the same	39	22
Less interested	9	0

Why did nine experimental students feel that their interest in science had decreased as a result of the course? The control class had the use of

modern college biology laboratory equipment, which might explain the fact that none lost enthusiasm. The other possibility is that some students who have already been exposed to eight years in a public school system which reinforces students for passively receiving information might react negatively to being given responsibility for their own learning, as they were under the format of this program.

Essays. Two independent raters read the essays, rated them on a scale from 0 to 3 on the basis of how much environmental awareness they exhibited, and came to a compromise on those initially disagreed on. They were unable to distinguish the experimental classes from the control class on the basis of their essays. The control class did slightly better on the "Ecology" essay, while the experimental classes did slightly better on the "Money" essay, but neither of these differences were even close to statistical significance. In general, the quality of the essays was discouragingly poor, with a number of experimental students saying they had no idea what ecology was. Apparently the implications of abandoning a money-based economy were too sophisticated for students this age to grasp, or else the environmental education was simply not powerful enough to shake them out of their usual frame of reference. A number of them expressed the idea that, if money no longer existed, the result would be more crime, especially stealing.

There are a number of possible explanations for the paucity of significant differences between the two groups of students. The first is that testing should have occurred at the beginning as well as at the end of the a given program in both the experimental and control groups. Proper evaluation of treatment effects can only be done this way. Secondly,

Mr. Sargo's program was only in practice for the last six weeks of the school year. It was designed for an entire school year or any portion thereof. It is highly likely that a program of such short duration, no matter how good it is, is unable to influence such basic attitudes as those toward life style and materialism in individuals who have been exposed to conventional parental attitudes for thirteen years and a conventional education system for eight years. As noted above in the discussion of the Environmental Awareness Survey, it is encouraging that a change on such a basic matter as who should be involved in deciding how many children people should have was observed.

Children who are accustomed to being spoon fed information which they memorize and regurgitate cannot be expected to be overjoyed at the opportunity to take responsibility for their own education. My own impression, based on only three visits to Mr. Sargo's class, was that the most serious deficiency in his program was the omission of any provision for motivating the students. The students must perceive learning about ecology as having something definite in it for them, or else they tend to view an unstructured seminar-type situation as an opportunity to get away with as little work as possible. Mr. Sargo's approach could in the future be combined with some of the reinforcement procedures used in behavior modification, which have been highly successful in dealing with some motivational problems in school. For example, the students might work towards an ecologically-oriented field or camping trip at the end of the school year or term.

Individual Project Report No. 2

Environmental Education at Mary Purcell Primary School by Laurie Lundgren

Paul Davenport

Ms. Lundgren wished to increase appreciation of natural resources among her students, second year in an ungraded primary. She had them collect newspaper for recycling through Georgia-Pacific Corporation. The children were told that recycling 120 pounds of paper was equivalent to saving a tree. The students also received extra practice in reading scales when they weighed their paper, in adding numbers when they totaled their poundage, and in writing letters through their correspondence with Georgia-Pacific.

It was hoped that the students in this class would not only be more aware of environmental problems and relationships, but also more interested in school, particularly arithmetic and creative writing. Two measures were used, an interview in which the students were asked questions about the environment and a survey on which parents were asked questions about the behavior of their children. These measures were administered to the experimental group at Mary Purcell School and to a control group at Clear Lake. The interview included the following questions.

1. Do you like school?

   (All children in both groups claimed to like school. The experimental group showed no particular enthusiasm for arithmetic or writing, although most of them were enthusiastic about their paper saving project, and the project apparently provided a means for some of the socially insecure children to find acceptance.)

2. How do trees help us?

3. What are natural resources?
4. What is pollution?
5. What kinds of pollution are there?
6. What, if anything, should we do about pollution?
7. What happens to the paper that we throw away?
8. What would happen if we didn't have trees anymore?
9. What would happen if we didn't have water anymore?

The children in the experimental group were interviewed in four groups of five and the children in the control group were interviewed in five groups of four. Ten University of Washington students were each paid $2.00 to listen to the tape recordings of these interviews with no prior knowledge that one group had had any formal instruction. Seven people rated the experimental group as being more aware and three people rated the control group as being more aware (six people heard the control group first, four heard the experimental group first). The responses from the control group seemed to be more uniform than those from the experimental group, i.e., with the control group each child generally had something to contribute to the interview whereas in the experimental group one or two children usually dominated the interview. The most informed of all the children was a girl in the experimental group who got most of her information from a Ranger Rick book that she had at home. The general awareness of the control group was such that possibly they were not typical. Because several schools in Clear Lake do have environmental education, there was probably sufficient interaction among the control group teacher, her students and their families with people involved in environmental programs, to affect their awareness.

With the surveys distributed to the parents there was a significant difference in the number of surveys returned by each group, 24 out of 28 surveys were returned by the experimental group, 9 out of 25 for the control group ($df = 1$, chi-square = 13.89, $p < .001$) indicating that greater parental cooperation and environmental concern had resulted from Ms. Lundgren's efforts. Additionally, surveys were scored on the basis of one point for each item checked plus one point for each additional comment. The mean score for the experimental group was 13.25, with 10.88 for the control group ($df = 31$, $t = 1.21$, $.05 < p > .10$). This difference is not statistically significant, however, it may be that parents who found few items to mark on the survey did not bother to return it. (See Appendix 1.)

Because the environmental group was dominated by a few students, some of whom did not get their information in class, the general effectiveness of the program is in question. It would be most worthwhile to test this class (and a control) next year. Ideally this kind of assessment should always be conducted both at the beginning and at the end of the school year and compared with a typical control group. This was the major limitation of this project.

Appendix 1

May 1971

Dear Parents,

Many Americans are concerned about our environment, its pollution, and our natural resources. The Sedro-Woolley Schools are interested in finding out whether elementary school children are aware of these problems.

On the following page are some questions about your child's activities for the last few months. Please take a few minutes to answer them and return the questionnaire to school. This is NOT a test and your replies will be strictly confidential. This information will help us do a better job of teaching.

Thanks for your help

_____
(Teacher's signature)

Age of your child _____

Sex M F

PLEASE HAVE YOUR CHILD BRING BOTH PAGES TO SCHOOL BY FRIDAY.

Consider your child's normal activities of the past six months.

I. Has he brought up or asked questions about any of the following topics?

__ Pollution
__ Ecology or environment
__ Conservation
__ Population
__ Recycling

II. Have you brought up or discussed with him any of these topics?

__ Pollution
__ Ecology or environment
__ Conservation
__ Population
__ Recycling

III. Has he done any of the following things?

__ Planted a garden
__ Cleaned, rearranged, or changed his room
__ Ridden his bike more often
__ Cleared, improved, or built something out-of-doors
__ Picked up litter
__ Used less water or electricity (turned out lights, etc.)
__ Helped in a recycling project (collected cans or bottles)
__ Asked more questions about things
__ Make up games for himself
__ Seemed to notice more things around him
__ Begun any new hobbies, like rock collecting
What? _____
__ Asked you to do something about pollution (to stop littering, use lead-free gas, etc.)
__ Become more interested in science

IV. Has he done anything else that makes you think he is aware of environmental problems? What? _____

_____

Individual Project Report No. 3

Sedro-Woolley Environmental Awareness Individual Project Report

for Mrs. Crippen, 6th Grade, Central Intermediate School

David Gruhn

The experimental group in this project was Mrs. Crippen's 6th grade class. The control group was another class of 6th graders from the same school, of approximately the same level, which class had not had special environmental teaching.

Both groups were divided into sections of five or six students each. Each section was taken off individually by the experimenter and asked 10 questions. The answers were tape-recorded to be tallied later. The same 10 questions were used for each section.

For tallying, the answers that each group gave were listed by question. One point was given for each different (from the answers) and acceptable answer (a very subjective process), and for each interactive discussion among the students about the pros and cons of an answer.

Results

As may be seen from Tables 1 and 2, Mrs. Crippen's group received a total of 92 points contrasted with 73 points received by the control, about a 25% increase over the control. Listening to the tape, one is impressed by the more thoughtful answers given by the control group. However, the experimental group is one of the lowest 6th grades in the school, so regardless of how close the two groups are, the control must be noticeably better. Table 2 presents just the first three questions for comparison.

It would have been more effective to have given the questions at the beginning of the school year to both groups and then to have compared answers (not to the same questions given the first time) of the groups at the end of the year. That would allow the difference in change in each group to be measured. To see which group changed the most is the correct way to evaluate differences as a result of different educational experiences.

Table 1

Tape Summary

Side 1 Experimental Group			Side 2 Control Group		
Section	Approx. Start on Tape	Students in section	Section	Approx. Start on Tape	Students in section
1	0	6	1	0	5
2	141	6	2	140	5
3	287	5	*3	280	?
*4	400	6	4	508	6
5	575	6	5	655	3
End	888	--	End	883	--

* Recorded at too low a volume; not used.

Acceptable Answers in Both Groups

Quest.	Exp.	Control
1	10	7
2	9	4
3	5	5
4	11	7
5	6	8
6	12	14
7	11	8
8	10	7
9	7	4
10	11	9

Number of answers/question/group

Table 2

Mrs. Crippen's Group

1) HOW DOES WATER POLLUTION AFFECT MAN AND HIS COMMUNITIES?

1. can't drink the water
2. can't irrigate with the water
3. kills animals
4. kills fish
5. bad for hearts
6. clutters water
7. clutters cities
8. run out of clean water
9. mercury pollution is killing things
10. can't get fresh water out of polluted water

2) WHY ARE WILD ANIMALS IMPORTANT?

1. food
2. recreation
3. scavengers
4. make clothing out of them
5. fertilizer
6. help gardens (ducks eat slugs)
7. aesthetic
8. help kill other harmful animals
9. needed for balance of nature

3) WHEN ARE THE TIMES YOU SHOULD BEAT-UP SOMEONE?

1. When they cause it
2. self defense
3. sports matches
4. not when they are bigger or smaller
5. never, should talk

Table 2 (continued)

Comparison of First Three Sets of Answers Given by

the Experimental and Control Groups

Control Group

1) HOW DOES WATER POLLUTION AFFECT MAN AND COMMUNITIES?

1. affects food animals--might affect people who ate them
2. kills food animals
3. bad to drink it
4. kills environment
5. mercury in canned tuna fish
6. run out of drinking water
7. not aesthetic

2) WHY ARE WILD ANIMALS IMPORTANT?

1. for balance of nature
2. food
3. scavengers
4. zoo (aesthetic)

3) WHEN ARE THE TIMES YOU SHOULD BEAT-UP SOME ONE?

1. never
2. they start it
3. don't gain anything by it unless it's for a wild game
4. talk it out with them before you beat them up
5. self defense

Individual Project Report No. 4

Measuring the Effects of Environmental Education for Lavone Trueman, Jim Ellis and Herb Sargo, 7 - 9th Grades, Cascade Junior High

Peggy Hollenbeck

The problem was to evaluate changes in values and behavior in junior high students resulting from innovative learning packages in environmental education. In order to measure the changes in values, it was first necessary to attempt to develop a questionnaire which would measure these differences. Groups of students who had received environmental learning experiences were grouped together under the title "environmentally educated." These students were hypothesized to have more desirable environmental values than students who had not had environmental education. Students at Sedro-Woolley and Marysville schools who were not in environmental programs were labeled "environmentally uneducated (control group) and were hypothesized to have less desirable environmental values than the experimental group.

Method

Subjects. Students in the experimental group (N = 215) included 130 art students, 52 language arts and/or poetry students, and 15 science students. The class which defined these aware students was the class in which they experienced the environmental program. The first two groups were from Sedro-Woolley, the third from Burlington. Teachers of all three groups, Lavone Trueman, Jim Ellis and Herb Sargo, respectively, were participants in the Northwest Environmental Education Center (NEEC)

teacher seminar. A fourth group of 18 students from Issaquah Junior High, Issaquah, Washington, was taking a course in man and the environment taught by Larry Little.

Students in the environmentally uneducated group (N = 541) included the remaining students at Cascade Junior High and 89 junior high art and 7 ninth grade science students from Marysville, Washington. Both Marysville and Issaquah are similar to the Sedro Woolley district in semi-rural location and population characteristics. (The teachers of the Marysville district were also being used as the control group for studying the NEEC teacher seminar.)

Of the total of 756 students, 409 were male, 347 female. All groups except two contained proportions of males and females similar to the entire population; the Issaquah group and the Marysville art group contained proportionately more males.

The Sedro-Woolley language arts-poetry group contained only eighth graders; the Issaquah students were all ninth graders. In all, there were 309 eighth graders and 224 ninth graders. All of the 223 seventh graders were in the Sedro-Woolley uneducated group.

Instrument. The questionnaire designed to measure differences in environmental values consisted primarily of questions adapted for junior high reading level from the adult Environmental Awareness Survey being developed by the Bureau of Testing. Additions included four questions testing the basic environmental concepts of population, ecology, pollution, and recycling and two reading comprehension items. Reading comprehension items were included to eliminate students who could not read the questionnaire. Inspection of the questionnaires whose reading comprehension items

were incorrectly marked, however, indicated that these persons were reading and responding correctly to other items. Students who missed the reading items were, therefore, not eliminated. Later results showed that all students had answered the pollution item correctly; therefore, all students were reading the questionnaires and the need for the reading comprehension item was eliminated in this instance.

All items were rewritten for the sixth grade reading level. Three junior high teachers, including a remedial reading teacher, read the questions and judged the vocabulary and conceptual level appropriate for junior high students.

Questions were then classified according to type (multiple choice or true-false), length of question and/or answer, content, and conceptual level (concrete versus abstract). They were then divided as equally as possible into four groups for four forms. Order of items within groups was varied according to classification so that similar questions would not be juxtaposed. All four forms began with a two-choice, relatively simple question. Each form contained thirteen questions from the environmental awareness survey which did not appear on any other form, the four questions on basic environmental concepts, and the two reading comprehension items. In addition, forms administered to the Sedro-Woolley group included a question to identify the art students. Each form then contained 19 or 20 questions and was completed by all students within a fifty-minute time period. These four forms, of which one appears as Appendix 1, may be obtained from the Bureau of Testing.

Procedure. The questionnaires were administered by classroom teachers. Each teacher received a stack of forms, containing all four forms in

alternate order. This method of distribution insured equal numbers of students answering each form. Teachers were also given two sets of instructions, one to read to the students and another containing additional information about the Sedro-Woolley project and the purpose of the questionnaire.

In addition to the responses of the students, responses to each of the four forms were obtained from six teachers. Three of the six were teachers of the environmentally educated students--Trueman, Ellis, and Sargo. The other three were fifth and sixth grade teachers from Sedro-Woolley district who were also participants in the NEEC seminar. The responses of these environmental 'experts' were used empirically to determine the correctness of student responses.

Results

A frequency analysis of all responses was made. The groups were then combined in four different ways and compared to determine significance:

(1) The first analysis compared the answers of all environmentally educated students to all uneducated groups; that is, the Sedro-Woolley art and language arts-poetry, Burlington science and Issaquah groups were compared to the rest of Sedro-Woolley and both Marysville groups.

(2) The second analysis compared the responses of the Sedro-Woolley art students and the Sedro-Woolley uneducated group.

(3) The third analysis compared the Sedro-Woolley art students with the Marysville art students.

(4) The fourth analysis compared the Sedro-Woolley environmentally educated groups (art and language arts-poetry) with the Sedro-Woolley uneducated group.

The test for significance in the first and second analyses was based on the actual distribution of responses among all answers. In the third and fourth analyses the responses were divided into two groups, right and wrong. This method of analysis was particularly useful in (1) differentiating both extremes from the middle of a continuum, (2) determining the direction of significance and (3) discovering the significant trends where differences were not apparent.

Of the 57 items evaluated only 13 had differences significant on the .10 level for at least one of the comparisons. (Three of these, unfortunately, were significantly different in the environmentally undesirable direction!) Thirteen additional items indicated at least one difference where the probability of chance occurrence was less than or equal to .25. Examples of "good" items are number 3 in Appendix 1 having to do with recycling--teachers and environmentally aware students significantly more often chose "b" than uneducated students--and number 13 when "c" was again selected by the environmentally educated and their teachers.

Among the questions in the more discriminating set, more "fact" as opposed to "opinion" items were found. All questions which discriminated in the wrong direction were opinion questions. Even though a 'correct' response to a fact question may not be the 'right' answer, the environmentally educated students are answering the fact questions in the directions predicted by the environmental experts.

Discussion

One of the questionable assumptions of this study was that all of the students were equal in environmental awareness before the learning packages

were introduced, necessary because testing was not done at the beginning of the school year. A second assumption was that tests were given under identical conditions, and a third, that presumably environment played a small role in the education of the "uneducated."

A problem in this investigation was the necessity of testing questions at the same time that subjects were tested. Essentially these students contributed to the construction of the instrument which may be used on future groups but because in test construction there is always item attrition, this evaluation suffers for not having a refined set of items on which to demonstrate the efficacy of this educational program.

Because of time limitations, frequency distributions by age and sex were not made. The age of students may affect the ratio of correct responses on fact as opposed to correct responses on opinion questions. The greater number of correct fact as opposed to opinion questions in the environmentally educated group suggests that environmental awareness at the junior high level is a factual awareness. Opinion formation may require further development and thus be affected by the age of the student. This may also mean that the students' adult models are still forming opinions about the environment. As both adults' and adolescents' individual and institutionalized awareness of, and concern for the environment increases, these opinions will grow and change. These changes will always increase the difficulty of establishing reliable measures on some other basis than fact.

Conclusion

This study identified 26 out of 57 items which show good potential as an environmental survey for junior high students. These items can now

be tested with newly written others in other junior high groups so as to locate (in time) a sizable pool of items for truly evaluating educational programs that seek to insure survival through greater ecological awareness.

Appendix 1

School_____ Birthdate _____

Your initials _____ Sex F M

Grade_____

ENVIRONMENTAL AWARENESS SURVEY

Answer all questions even if you must guess. Circle only one answer.

1. Littering the highway is worse than drunk driving.

   a. True
   b. False

2. Which of the following is least dangerous to children living in the city?

   a. lead poisoning
   b. rat bite
   c. fire
   d. drinking impure water that causes typhoid

3. Recycling means

   a. that we should let garbage decay so that we return to the earth what we have taken out.
   b. that garbage should be thought of as a source of raw materials.
   c. that natural "cycles" of animal and plant life should be changed to help man.

4. Should the population of the earth stop increasing?

   a. Yes, as soon as possible because the kind of life we have now is not as nice as it was a few years ago.
   b. No, because technology will make a better life for more people in the future.

5. A small electric car pollutes less air and makes less noise than the cars we use now, but a small electric car is not practical for driving in the city.

   a. True
   b. False

6. Ecology is
   a. the study of the environment and living things, and how they get along together.
   b. the study of the environment.
   c. the study of living things.

7. When recycled, a pop bottle can be used

   a. 3 to 5 times
   b. 18 to 20 times
   c. 45 to 50 times

8. (art elective question)

9. Is it all right for a lumber company to cut down trees as long as it makes sure there will be plenty of trees to cut down in the future?

   a. yes, because that is good ecology.
   b. no, because the land used to grow trees could be used for national parks.

10. When you finish reading this question circle answer "a."

   a. Sedro Woolley
   b. Burlington
   c. Mount Vernon

11. Pollution is

   a. putting harmful chemicals or garbage into the air and water.
   b. not my responsibility.
   c. the name of a popular song.

12. The U.S. should not decrease its population growth until most other countries agree to decrease their population growth, too.

   a. True
   b. False

13. Pretend you are a member of a committee in charge of county parks. The United State Government Engineers would like you to flood most of a wildlife preserve to make a water reservoir for your town. The Engineers show you that the new reservoir could be a lake for swimming and boating. Do you vote

   a. to flood the land, but keep it as a wildlife preserve.
   b. to flood the land, and use it for swimming and boating.
   c. not to flood the land.

14. All power pollutes.

   a. True
   b. False

15. Environmental awareness means

    a. to know facts about the world around you and how to preserve it.
    b. to be able to read and write and do arithmetic problems.

16. Sources of atomic energy that do not pollute are

    a. presently available and being used.
    b. not available now and will not be for five years.
    c. not available now and will not be available for fifteen years.

17. Putting chemicals into the water is bad because some chemicals

    a. kill people.
    b. kill fish and other animals in the water.
    c. make algae grow which chokes out other animals.
    d. give water a bad smell.

18. The rate of population growth is measured by

    a. the number of people who die each year.
    b. the number of people who are born each year.
    c. both of the above.

19. Pesticides are chemicals that kill insects. Pesticides are tested by

    a. The Pesticide Regulation Division of the U.S. Department of Agriculture.
    b. People who study the chemical pesticide.
    c. People who make the pesticide.

20. When did pollution first become a <u>serious</u> problem?

    a. 200 years B.C. (before Christ).
    b. 1825.
    c. following World War II in 1945.
    d. last year, 1970.

Individual Project Report No. 5

Measuring the Effects of Environmental Education for Ms. Iavone Trueman, 9th Grade Art, Cascade Junior High

Peggy Hollenbeck

The problem was to evaluate changes in values and behavior resulting from innovations in environmental education. The group under observation was the art students of Ms. Iavone Trueman, Cascade Junior High, Sedro Woolley, Washington. Changes in the values of these students were evaluated by the environmental awareness survey the results of which are contained in Project Report No. 4 of this report. Changes in behaviors had been observed by Ms. Trueman leading to the hypothesis that given the same project, her art students would use fewer materials per person than students in a similar class taught by another teacher.

Method

The availability of suitable controls determined the subjects. The only class of art students in the Sedro Woolley District not taught by Ms. Trueman was a ninth grade crafts class taught by Ms. McKee. Ms. Trueman's ninth grade art class was therefore selected for testing. Both teachers stated that students in both classes had had similar art experiences during the year. Ms. McKee's class, however, had received no environmental education. Ms. Trueman's classes had used reclaimed materials for their projects and had placed waste paper in recycling boxes whose contents were periodically taken to a paper mill for reprocessing. Although students were directed to use both sides of a piece of drawing

paper, no specific reference to the environment was made. Both groups were aware of the school's budget limitations and therefore, that supplies were not unlimited.

Testing took place in the art room, the classroom for both groups, during Ms. Trueman's class time. On the day of testing 13 students (nine girls, four boys) from Ms. McKee's class and 14 (seven girls and seven boys) from Ms. Trueman's class were present.

A tear and paste project in value had been chosen. Pairs of students, one from each group, were asked to reproduce a section of a black and white photograph. Twelve matched pairs of section were completed. The photograph was to be reproduced with one-inch squares of construction paper ranging in value from black to white. The supplies given to each group were identical in quantity, weight, and distribution of value. Each set of supplies weighed .810 grams.

A tear and paste project was chosen because (1) the materials were inexpensive and easily obtained, (2) the choice of paper was not influenced by color preference, and (3) the size of the project could be controlled. The original reason for choosing a group rather than individual and same rather than different projects was to create a competitive atmosphere, thereby motivating the slow students to complete their section within the class period.

Instructions to the students included identification of myself as a student teacher who wanted to compare two groups of art students taught by different teachers. They were also told that because the experimenter could not tell the individuals in one group from those in the other, that each group would sit at one of two large tables. The supplies were placed on tables for them. Students spent from ten to 45 minutes on the problem.

Results

At the end of the hour all of the paper not used by the students was collected separately and weighed. Ms. Trueman's class used .021 g or .0015 g of paper per person. Ms. McKee's craft class used .028 g or .0022 g of paper per person, 50% more material than the environmentally-aware art students. The difference, therefore, was measurable and in the predicted direction.

Discussion

In addition to the difference in amount of paper used, there were differences in the manner in which students worked with the materials. McKee's group left the materials on the table in much the same way as they were placed; they were also more reserved and passive than the other group. Ms. Trueman's group scattered the pieces of paper over the table and a few on the floor. These differences could be attributed either to carelessness or greater cooperation and interaction among each other. Ms. Trueman's explanation is noteworthy. She had noticed that her students this year as compared to previous groups had developed a freer approach to use of materials which were free, and in most cases, in unlimited supply. Although it cannot be claimed that the emphasis on environment changed student behavior towards the products of environment, it is suggested that the student's attitude towards art progressed in a positive direction which was not at the expense of the environment. Increased artistic enjoyment should lead to increased aesthetic awareness and appreciation and more positive attitudes towards one's visual environment.

Comments

If these observations were to be repeated it is suggested that a seventh grade class rather than a ninth grade class be used for the following reasons:

(1) fewer individual differences were observed among the younger students;

(2) seventh graders, unlike eighth and ninth graders at Sedro Woolley, are required to take art and therefore any one class would be more representative of seventh graders at other schools;

(3) the seventh graders were taught by the same teacher, Ms. Trueman, therefore the differences between teachers could be controlled, the only variable being the presence of the environmental education;

(4) if (3) were followed, testing could be accomplished separately during the customary class time and therefore, under more normal circumstances.

Individual Project Report No. 6

Evaluating a First Grade Environmental Education Program

Sandra K. Mitchell

A serious problem facing educational innovators is that of evaluating their innovations. These evaluations serve at least two distinct functions. First, they provide feedback for the classroom teacher about the level of her pupils' skills and knowledge, and therefore about the effectiveness of her teaching. Second, long term evaluation can indicate whether a whole curricular package is effective and efficient.

Evaluation of the first sort is reasonably easy for a classroom teacher to obtain. She questions students, gives them tests, reads their papers and assignments, listens to their comments. All of these give her ongoing information about the immediate impact of her educational efforts.

But comprehensive, comparative evaluation is another story altogether. Few classroom teachers have the time, resources, or research skills which are called for. But the school principal, the school board, and outside funding agencies want to know--need to know--how effective innovations are compared to alternative methods. So long as there are limited resources available to education, there is an obligation to spend those resources in a way that yields maximum benefits. That obligation demands that the benefits be measured and compared.

The introduction of environmental education into the Sedro Woolley schools has made both kinds of evaluation necessary. There is no question that the participating teachers have done informal, ongoing evaluations in

their classrooms. The study to be reported here involves comparative evaluation of a classroom project in environmental education.

There are two ways that the comparative evaluation question can be posed. One is, "How have the children in this classroom changed because of their educational experience?" To answer this question, it is necessary to test the students both before and after the program on the traits that the program is designed to change. Alternatively we can ask, "How are the children in this classroom different from those who have not had this educational experience?" This question is answered by comparing two different groups of children, one which has had the program and one which has not, on the relevant traits.

The most favorable research strategy is to ask the question both ways by testing an experimental (innovative) group and a control (standard) group both before and after the innovative program is presented. Unfortunately, this procedure was not possible in the present study. Therefore, we shall be concerned only with the second version of the question--how do the children in an environmental education curriculum compare with children in a standard curriculum?

The subjects in the study attended a first grade class taught by Angelyn Shafer at Big Lake School. Mrs. Shafer is a participant in the NEEC seminar and has developed several curriculum innovations for introducing environmental topics to young children. There are 21 children in her class, 14 boys and 7 girls.

The comparison, or control, group for the investigation was a first grade class taught by Agnes McIlraith at Madison School in Mount Vernon. There were 8 boys and 15 girls in this class. The group was chosen for

several reasons: it was approximately the same size as Mrs. Shafer's class, it was in the same geographic area, and the teacher was cooperative. More importantly, Mrs. Shafer and Mrs. McIlraith taught reading and writing in the same fashion, and both used the open-classroom approach.

Of course, the classes were not identical. Big Lake School's pupils all lived in a rural area, while many of Madison School's students lived in town. The groups were not matched on factors like intelligence, socio-economic status, parent's educational level, or kindergarten attendance. And the proportion of male and female students was almost exactly opposite in the two classes. Nonetheless, the two seemed similar enough to warrant comparisons on the environmental education material.

The first step in the evaluation was to specify the goals of the program to be evaluated. These were:

1) To improve general perceptual skills. The children should be more observant, see relationships more clearly, and make inferences based on their observations.

2) To change values. The children should place higher value on ecologically sound practices, have concern for the welfare of living things, gain enjoyment from nature, and appreciate the importance of preserving their environment.

3) To gain knowledge. The children should have a clearer understanding of the natural causes of physical events, rather than attributing them to magic or accident.

4) To change behavior. The children should show changes in their everyday activities reflecting these new skills, values, and knowledge.

The second step was to locate or construct assessment instruments appropriate to these goals. Since the children were young and not expert readers, it was decided that conventional paper and pencil tests and surveys that might be used with older children and adults would be unsuitable. And it was felt that the assessment should be done individually or in small groups rather than with the class as a whole. Finally, to get full cooperation of the children, it was important to choose things that would be fun for them to do. From all of these considerations, the following were selected.

1) The Raven Coloured Progressive Matrices Test. Each problem in this test consists of a printed, brightly colored design or pattern with a piece "cut out" of its lower right hand corner. Printed below this are six "pieces" that might complete the design. All six are the right shape to fill the space, but only one will properly finish the design. The child's task is to find the correct missing piece. Problems include all-over designs, incomplete shapes, and some items best described as non-verbal analogies. There are 36 problems, arranged in three sets of twelve problems. Items in each set become progressively more difficult, as do the sets themselves.

In Raven's words, the test was designed to assess the "capacity at the time of the test to apprehend figures presented for his perception, see relations between them, and conceive the correlative figures completing the systems of relations presented." Although it is normally used as a brief test of non-verbal intelligence, it seemed as though the emphasis on perception, relationships and inference made it appropriate for assessing

the first goal above. Moreover, the Progressive Matrices are easy to administer, children find them engrossing, and some approximate norms are available.

2) The Guilford Apparatus Test, adapted for our use. This test consists of the subject naming two "improvements" for each of five common household objects (garbage can, TV, lawn mower, toaster, bicycle). As originally designed, the test was supposed to measure a factor called "Sensitivity to Problems," and was scored for number of "drastic" and "minor" revisions named. We felt, however, that the children's notions about "improvement" would reflect their values about what is "good." Objects were chosen for which both ecologically sound and unsound improvements were possible. Two scores were obtained for each child: one for the number of positive suggestions (+App), and one for the number of negative suggestions (-App). However, most answers turned out not to be ecologically based at all. So for statistical purposes, each child received either a score of 1 (for one or more positive environmental answers) or 0 on +App, and either a 1 (for one or more negative environmental answers) or a 0 on -App.

3) Interviews. Children in both classes were interviewed in groups of three to five children each. Each interview consisted of a number of general questions about the physical world. Questioning followed the model of Piaget's clinical method, in which the children are asked to elaborate and explain their answers. Interviews were tape recorded, then transcribed. The thirteen most answered questions were selected, and all answers to those questions collected from each class and prepared on

separate pages. Naive raters then judged for each question which collection of responses showed the greatest environmental awareness.

4) Parent Questionnaire. A one-page, four part questionnaire was sent to the parents of each student in both classes. Part I asked if the child had raised questions about any of five listed topics. Part II asked which of the same five topics had been brought up by the parents for discussion. Part III listed 13 activities and asked which ones the child had done in the past six months. And Part IV asked for any other changes in the child that indicated he was more environmentally aware.

5) Teacher Evaluations. Each teacher rated each of her students on the following five traits: intelligence, environmental awareness, creativity, cooperation, and independence. Rating was done on a seven point scale, with 7 indicating a high amount of a trait or characteristic, 4 an intermediate amount, and 1 a low amount.

These instruments were administered in Big Lake School in the first two weeks of May, and in Madison School in the last two weeks of May. All of the interviews were conducted by the author; the Progressive Matrices and Apparatus tests were administered by the author and another trained examiner. A third examiner tested four children at Big Lake School, but due to an error in administration, those four tests will not be considered in our data analysis.

Results

1) Progressive Matrices. Each child's score was the number of problems he correctly solved. The experimental group averaged 18.76 correct answers; the control group averaged 17.48 correct answers.

Although the experimental group did somewhat better, the difference between the two groups was not statistically significant ($t = .826$, $df = 38$, $.05 < p < .25$, one-tailed).

The performance of each group was compared with the norms provided with the test (norms used were for age 7 years, since this was the age most children reported for themselves). The mean and median score of the norm sample were 17.47 and 16, respectively. Although both of the groups scored above that, none of the differences were statistically significant (t values ranged from .04 to .67).

2) Apparatus Test. Each child had two scores, one on +App (positive environmental responses), and one on -App (negative environmental responses). Each score was either one or zero. Statistical tests were done to determine if the two groups differed in the number of environmentally sound and unsound responses. There was no difference between groups for environmentally sound answers ($x^2 = .47$, $df = 1$, $p < .50$). However, the control group had a significantly higher proportion of children giving environmentally unsound responses ($x^2 = 6.81$, $df = 1$, $p < .01$).

Most of this difference was due to the fact that no girls in the experimental group gave any -App answers. This was significantly fewer than those given by the boys in their own class ($x^2 = 9.4$, $p < .005$) or the girls in the other class ($x^2 = 9.2$, $p < .005$).

3) Interviews. The written protocols were rated by five judges, none of whom knew which responses came from which group. Since there were 13 questions, this resulted in 65 judgements of which group was more "environmentally aware." Of these 65 judgements, 24 were in favor

of the experimental group and 41 in favor of the control group. This was significantly fewer choices of the experimental group than can be accounted for by chance alone ($z = 2.17$, $p < .015$).

However, in spite of instructions not to be influenced by sheer length, it seems likely that the judges' ratings were influenced by the number of responses in the sets they were to rate. In fact, of the 65 comparisons, judges chose the longer collection of responses 50 times and the shorter collection only 15 times. This is many more than we would expect by chance alone ($z = 4.5$, $p < .0001$).

It is worth noting that the quality of the answers given by the children in both groups was high compared to the responses Piaget has obtained with similar questions. He found that few children could account for phenomena like clouds, seeds, or wind in a naturalistic way before the age of ten or eleven. Clearly, several children in both classes were able to do this.

4) Parent Questionnaire. Fourteen parents in the experimental group and seven parents in the control group returned completed questionnaires. This is a significant difference in return rates ($x^2 = 5.78$, $df = 1$, $p < .025$).

Since the questionnaire consisted of items that were to be checked if they had occurred, scoring involved simply summing the number of checkmarks on each returned questionnaire. All responses to Part IV, regardless of their length or content, were scored one point. The mean number of responses for the control group was 9.3 and for the experimental group was 12.6. Although the experimental group has a higher average score, the difference between the groups did not reach conventional significance levels ($t = 1.38$, $df = 19$, $p < .25$)

The remaining analyses were concerned, not with differences between the two groups, but with the relationships among the measures within each group. Five measures were considered: score on the Progressive Matrices test (PM), Apparatus test positive scores (+App), Apparatus test negative scores (-App), teacher ratings of intelligence (Intell), and teacher ratings of environmental awareness (En Aw). Each of these was correlated with the other four and the resulting inter-correlation matrices are shown in Table 1 for the experimental group and Table 2 for the control group.

Table 1

Correlations Among Measures Taken at Big Lake School

	PM	+App	-App	Intell
+App	-.20			
-App	.31	.06		
Intell	.55	-.15	.17	
En Aw	-.26	-.34	.27	-05

Note: Values greater than .36 are statistically significant ($p < .05$).

Table 2

Correlations Among Measures Taken at Madison School

	PM	+App	-App	Intell
+App	.29			
-App	.19	.16		
Intell	.26	.09	.29	
En Aw	.15	-.14	.23	.62

Note: Values greater than .35 are statistically significant $p < .05$).

In both groups we find a positive correlation between PM and Intell. However, the relationship between PM, En Aw and Intell differs in the two groups. In the experimental group, Intell and En Aw are uncorrelated, and the PM correlates positively with Intell and negatively with En Aw. On the other hand, in the control group, Intell and En Aw are highly correlated and both are positively related to scores on the PM. This suggests that in classes where environmental education takes place, environmental awareness develops apart from intelligence. The PM, as well as the teacher ratings, are sensitive to this differentiation. On the other hand, when no special environmental education takes place, environmental awareness is no different than intelligence, and the PM is related positively to both.

The relationship of the Apparatus test to the others is less clear. In both groups, there was a small positive correlation between +App and -App. In the experimental group, PM, Intell, and En Aw each correlates negatively with +App and positively with -App. This means that the higher the scores on those three measures, the fewer environmentally positive and more environmentally negative answers were given to the Apparatus test. This is exactly the opposite of what we expected. In the control group, this puzzling relationship between the Apparatus test and En Aw was repeated. More puzzling still were the positive correlation of both PM and Intell to both +App and -App. Obviously, the Apparatus test was not sensitive to the traits we were trying to measure.

Discussion

It is clear that there were few dramatic differences between the experimental and control groups we studied. Nonetheless, it would be

incorrect to assume that Mrs. Shafer's interest in the environment made no difference to her students. The method we used--comparing the average performance of two groups of children--is completely insensitive to changes in individual children that may have taken place over the last year. Only a study which uses measures of the same children before and after an educational program can assess these developmental changes. And it was apparent that there was great variability among the children in each class. Each group had a few very bright, talkative, outgoing youngsters and several shy, quiet ones; some children approached the Apparatus test eagerly while others could think of no answers at all.

Equally important is the fact that a between-groups comparison is relatively insensitive to small changes in children. It is unlikely that any one set of experiences will change a child drastically. Rather, the children are likely to show small changes on a number of attributes. And our method could not evaluate these numerous, small changes.

It must be remembered, too, that this was a pilot study. And as such, it has provided important information to be used in future evaluations--information about instruments and methods.

The Progressive Matrices test is a quickly administered, easily scored, "fun" test that seems to measure children's "perceptual intelligence." It is not, by itself, a measure of environmental awareness, but it does measure a skill that is necessary for environmental awareness. Its use in the future should continue to be as part of battery of tests used with this age group.

The Apparatus test in its present form is not helpful in assessing environmental awareness. Some children never understood the task, and

others often repeated a single "improvement" for all objects mentioned. More importantly, it was unreasonable to assume that questions about "improvements" would elicit answers reflecting environmental concerns. It might be possible to rewrite the instructions or examples in order to make it explicit that ecological matters were appropriate answers.

The Interviews were also somewhat unsatisfactory. Again, the problem was that their content was too general to differentiate children with and without environmentla knowledge. Had the questions asked been more directly related to environmental problems--pollution, littering, recycling--these differences might have been exposed. Indeed, group interviews using direct questions have been successfully used to discriminate between groups with environmental training and those with none (Davenport, Project Report No. 2).

The Parent Questionnaire was a fairly successful venture. Its main drawback was the low return rate achieved from the control group. It may have been the case that the parents who failed to return them had no items to answer affirmatively. (If that had been the case, the difference between scores for the experimental and control groups would have been statistically significant). In the future, it would be wise to enlist the aid of a comparison class throughout the year, to enlist more parent participation.

Teacher ratings, despite their obvious limitation, remain an important source of information about school children. Although not trained in psychological measurement, teachers have far more opportunities to observe their students than would any outside experimenter. In the future certain other traits, such as curiousity or interest in science, might be included.

In summary, we found that a first grade class exposed to an environmentally enriched curriculum showed slight, but fairly consistent, superiority over a first grade class without that enrichment. Our experimental group had higher scores on a test of "perceptual intelligence," fewer "environmentally negative" answers to an Apparatus test, sophisticated understanding of physical events, and a tendency to show their environmental concerns in their everyday activities. And they clearly showed that environmental awareness is a trait distinct from intelligence in general.

As a pilot study, these results are encouraging, but hardly conclusive. What remains now is the important task of applying what was learned to a more comprehensive, year-long evaluation study. We know that we need to test children in both experimental and control groups at the beginning and the end of the year. We know that we should ask them questions specifically about environmental problems. And we know that the Progressive Matrices test, the Parent Questionnaire, and ratings by their classroom teachers can be used.

Most importantly, we know that we are obliged to do that comprehensive study. Without it, we cannot be sure that the time, enthusiasm and energy of the NEEC participating teachers is being spent in the most effective way.

Individual Project Report No. 7

Evaluation of a Special Curriculum for Grade Schoolers: Ecology, Awareness of Self and Awareness of Others

Brett C. Trowbridge

Several teachers of the Sedro Woolley School District, Sedro Woolley, Washington, have initiated special programs in their classrooms aimed at improving the ecological awareness of their pupils. Adequate evaluation of these programs must be undertaken on an individual basis, for each teacher has utilized a different approach and has envisioned different objectives.

Mrs. Gloria Abrahamson taught a combined second and third grade class at Lyman School in Lyman, Washington. All sixteen students (nine males, seven females) lived in a rural environment. Most of the children came from lower socio-economic backgrounds, and many of their families had recently migrated to Washington from West Virginia and North Carolina. Many were poor students; several had repeated one or more grades in school.

Program

Under the rubric of a rather broad definition of "ecology," Mrs. Abrahamson specified three objectives of her program. She hoped (1) to help each student to become more aware of himself and how he perceives the environment, (2) to encourage her children to begin to think of how they need other people, and how other people need them, and (3) to assist each student in keeping in touch with himself through the process of introspection. The teacher felt that success with these three goals would contribute to increased self-esteem among her students.

Mrs. Abrahamson designed ten "environmental encounters" aimed at fulfilling these objectives. These encounters were conducted during the 1970-71 school year. One encounter, for instance, consisted of a walk through nearby Lyman City Park. The students were provided with cameras and photography was used as a medium for exploring in depth the natural phenomena of the park. The children were also encouraged to pose for group portraits, providing an ideal opportunity for practice in group cohesiveness and cooperation. During a subsequent class discussion students considered such questions as "What is fun about going to a park?" "Who takes care of our park for us?" and "What can we do to make our park a better place?" All photographs were developed and distributed to the students.

The students also "encountered" fresh fallen snow, a windy rainy day, several hogs in a pasture and the school lunchroom during lunch hour. During each encounter the pupils were instructed to imagine that they had never experienced the environment before, and to use their senses to discover as much about it as possible. Detailed awareness of sensory input at an intimate individual level was emphasized, and students were encouraged to express their feelings about their environment, about each other and about themselves in each situation. A critical evaluation of what was wrong with the school environment was undertaken in one encounter. Two sessions were devoted to integration of sensory perceptions with emotional perceptions in such a way that each student was better able to answer the question "Who am I?" How survival is dependent upon cooperation between people and conservation of material resources was considered in two further sessions. Throughout the program an effort was made to foster creativity,

independence and social maturity through a flexible innovative unstrucutred approach.

Method

By far the "cleanest" procedure would have been to collect data from Mrs. Abrahamson's experimental class and a comparable control class without an ecology curriculum both at the beginning and at the end of the school year. Unfortunately this was impossible since evaluation was not undertaken until the school year was nearing completion. Instead a single comparison at the end of the year was made between the performance of the experimental class and eighteen control students (eleven male, seven female) from a nearby school. This control class was selected because it consisted primarily of students from rural lower socio-economic backgrounds; thus, it represented the best available match to the experimental group. The control group's teacher utilized traditionally directive teaching techniques. The Stanford Binet Vocabulary List was administered to all students as a measure of verbal achievement, and the age and sex of each subject was recorded.

Three measures of ecological consciousness were devised, each corresponding to one of the three original goals specified by the teacher. All three measures were administered individually to each child during a one hour testing session. The tester read questions to the children and recorded their verbal responses. Scoring criteria were specified before testing began.

Each item in Measure I, Awareness of Sensory Processes and Perceptions of the Environment, required the child to imagine a specific environment. The child was required to provide as many responses as possible demonstrating

his awareness of that environment. On some questions exceptionally perceptive responses were given more weight according to a pre-specified scoring system. This test was heavily loaded in favor of the experimental subjects since each question referred specifically to one of the environments "encountered" by that group. For example, one question asked "Can you tell me as many reasons as you can why you like going to a park?" Responses referring to the natural environment (e.g., "You might see some birds there!") or to the ready availability of other people (e.g., "There's kids there to play with.") were given two points each, while other responses (e.g., "Things to play on.") were given one point. Simple rewording of the question (e.g., "It's fun to go there!") were not given credit. Points on all questions were summed to arrive at the total score. The children were given as much time as needed in order to elicit all responses. One question was eliminated due to the paucity of acceptable responses produced.

The first hypothesis was that the experimental group would achieve significantly higher scores on this measure due to their experience in analyzing their perceptions of these environments. If no significant differences between the experimental and control groups could be demonstrated, the conclusion would follow that the "environmental encounters" had been ineffectual as a teaching method.

In order to obtain credit on each of the tem items in Measure II, Awareness of Other People, the child was required to demonstrate insight into the effects of a given action on others. Spontaneous correct answers were assigned two points; correct responses elicited after prompting were given one point; incorrect responses were given no credit. For instance, one question was "Why do we put people in jail if they steal and

rob?" If the child responded "They might take something away from poor people " he received two points. On the other hand, if the response was "Because its against the law.", the tester would inquire "Yes, but why is it against the law?" An acceptable response elicited at this point received one point. Points on all questions were summed to arrive at the total score. Four questions were eliminated from the final tabulation because only very few subjects were unable to give the correct response.

The second hypothesis was that training in awareness of the feelings of other people would generalize to the test items, causing the experimental group to achieve significantly higher scores on this test. An absence of a significant difference on this test would indicate a failure of the classroom instruction to generalize to situations not discussed in class.

Measure III, The Process of Introspection, was designed to measure to what extent each child was in touch with his feelings. It required children to associate feelings and situations. Sample questions are "How do you feel when you know that you have done a good job at something?", and "When do you feel mean?". One point was credited for each acceptable response, but essentially identical responses were scored only once. On some questions certain categories of responses were scored only once regardless of how often they occurred. For example, if a child responded to the question "What could happen that would make you cry?" with a series of responses referring to physical pain (e.g., "Fell on my bike. Scraped my knee. Got hit by a baseball bat.") only one point was awarded. Responses not involving pain (e.g., "If my Mom yelled at me. My dog died.") were

assigned one point apiece. Subjects were given as much time as they required to give as many responses as they were able.

The third hypothesis was that the emphasis placed on introspection in the classroom would significantly elevate the scores of the experimental group on this test. No differences between groups on this test would indicate that the training in introspection had been insufficient to effect a measurable change in verbal output.

Analysis

The data were computer analysed according to a linear regression model. An analysis of covariance was performed on each of the three dependent measures using a 2X2 design--Sex X Treatments. Age (in months) and Stanford Binet Vocabulary Scores for each subject were normalized ($\bar{x} = 5.0$, $s = 1.0$) and included as covariates. In addition, the product of the normalized Age and Vocabulary scores was included as a third covariate in an attempt to control for the effect of Age on Vocabulary scores.

A simple 2X2 Sex X Treatments analysis of variance was also performed on each of the three dependent variables to test whether the covariates used in the analysis of covariance accounted for a significant portion of the overall variance.

Results

The analysis of covariance revealed a significant effect for Measure I ($F_{1,27} = 44.27$, $p < .01$) as did the analysis of variance ($F_{1,31} = 32.11$, $p < .01$). The mean for the experimental group on this test was 14.94; the mean for the control group was 8.68. Neither the main Sex effect nor the Sex X Treatments interaction were significant for either analysis. Inclusion

of Age, Stanford Binet Vocabulary Score and Age X Vocabulary as covariates did not significantly reduce the overall variance.

Similarly, both the analysis of covariance ($F_{1,27} = 10.45$, $p < .01$) and the analysis of variance ($F_{1,31} = 15.69$, $p < .01$) revealed significant results for treatments on Measure II. The experimental group mean was 9.70; the control group mean was 6.68. Sex and Sex X Treatments effects did not reach significance. The analysis of covariance did not significantly effect analysis of variance results.

Finally, Measure III also differentiated experimental and control groups in both analyses: $F_{1,27} = 30.63$, $p < .01$ for the analysis of covariance, and $F_{1,31} = 11.58$, $p < .01$ for the analysis of variance. The experimental mean was 28.57; the control mean was 21.88. Sex and Sex X Treatments were not significant. The covariate analysis did not significantly reduce the variance.

Discussion

Since the experimental group scored significantly higher than the control group on all three tests, we can conclude that Mrs. Abrahamson's curriculum was a success. Not only did Mrs. Abrahamson's students perform better on Measure I, which asked direct questions about the "encounters" which they experienced, but they also scored higher on Measures II and III, which required generalizations to new situations. They were significantly more aware of the feelings of other people and of their own feelings (as measured by the tests utilized here) than were the control students.

These results are surprising. It is difficult to understand how ten "environmental encounters" could have effected such a dramatic difference. Clearly, Mrs. Abrahamson's students must have received instruction in these

areas outside the "encounters" in which they were specifically discussed. It was the tester's impression that Mrs. Abrahamson's style of teaching had much to do with the measured differences. Mrs. Abrahamson's class was conducted in a relatively unstructured manner which allowed students to express their opinions and their feelings without inhibitions. In contrast to the control class, their approach to the test situation was characteristically spontaneous and enthusiastic. This may have been at least partially due to the small size of the experimental class, which allowed Mrs. Abrahamson to give her pupils a relatively large amount of personal attention.

Interestingly enough, neither Age nor School Achievement (as measured by the Stanford Binet Vocabulary List) had a significant effect on any of the measures of ecological and interpersonal consciousness used in this study. The original hypothesis was that since all three tests called for verbal responses, and since high scores were assigned when the verbal responses were particularly elaborate and extensive, scores on all three measures would correlate highly with both Age and Vocabulary. Apparently children of any age and aptitude, represented within the ranges studied here, can do well on these tests if they are sufficiently attuned to the subtle dynamics of their interpersonal environment. If the children had been required to supply written responses instead of verbal responses, Age and Vocabulary scores might well have had a significant effect on the scores a child received on these tasks. Hence a mass administration of these tests to the entire class could have been inappropriate since the required written responses were more strongly determined by age and aptitude.

Even though females in this age bracket characteristically outscore males on achievement tests, no significant Sex effects or Sex X Treatments interactions were noted. This lends additional support to the tentative conclusion stated above that ecological and interpersonal awareness are orthogonal to general intelligence and achievement factors.

Perhaps the most fundamental and far-reaching inference to be drawn from these results is that the traditional highly structured, directive and interpersonally distant teaching method stifles the development of ecological and interpersonal awareness.